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New Tropical American Ferns—IV[1].

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The three ferns here described as new are all from Costa Rica, and are of exceptional interest in their respective genera.

Rhipidopteris Standleyi Maxon, sp. nov.

Plants colonial, the rhizomes filiform (less than 0.5 mm. thick), extensively creeping, flexuous, sparingly branched, dark brown, angulate, deciduously paleaceous, the scales lax, oblique, subimbricate, mostly lance-attenuate, 2–3 mm. long, thin, dull fulvous, entire. Sterile fronds numerous, 1–2.5 cm. apart, erect, 1–3.5 cm. long, the stipe 0.5–2.5 cm. long, slender, laxly paleaceous, narrowly alate upward; blades simple, 0.8–1.8 cm. broad, roundish-obdeltoid to transversely oval or oblong, at base truncate or broadly cuneate and usually abruptly decurrent, the margins here entire; apical portion broadly rounded, evenly crenate, the teeth subequal 1–1.5 mm. broad, broader than long; venation flabellate-radiate, evident in drying, the vein-tips solitary within the marginal crenations; leaf-tissue rigidly herbaceous, scantily paleaceous, the scales of the lower side lance-deltoid, subpeltate, those of the upper side linear and tortuous. Fertile fronds few, 3–4 cm. long, the stipes filiform, 2.5–3.5 cm. long; blades simple, reniform, 7–

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10 mm. broad, subentire, or repand-crenate except at the re-entrant sinus, densely sporangiate, only the broad whitish margins naked.

Type in the U. S. National Herbarium, no. 1,215,446, collected on a wet mossy bank near La Hondura, Costa Rica, altitude about 1,300 meters, March 2–4, 1924, by Paul C. Standley (no. 36464). In company with Prof. Juvenal Valerio Mr. Standley collected also an excellent series of specimens in the general region of Tilarán and El Silencio, Province of Guanacaste, at an altitude of 500 to 750 meters, in January, 1926, his numbers being as follows: 44454, 44663, 44678, 45265, 45406, 45925, 46258; all these grew on the mossy trunks of forest trees.

A proper classification of the abundant material of *Rhipidopteris* found in American herbaria is difficult. Ordinarily three species are recognized: *R. peltata*, *R. foeniculacea*, and *R. flabellata*, all very much alike in type of venation but widely different in dissection, at least in their extreme forms. *R. foeniculacea* (Hook. & Grev.) Schott is probably best regarded as an extremely fine-cut form of *R. peltata* with nearly filiform divaricate segments; and even *R. flabellata* (Humb. & Bonpl.) Fée, which in its usually bifid or quadripartite sterile blades seems distinct enough from the well known *R. peltata*, is partially connected with the last by a recent series of Costa Rican specimens. Most distinct of all, however, is the plant here described, in which there is no indication whatever of lobing or dissection of the sterile blades. This form is abundant locally in western Costa Rica, often occurring to the exclusion of *R. peltata*, and on the basis of present material it may justifiably be accorded full specific rank; yet the entire series of *Rhipidopteris* specimens stands with very few unfilled gaps between *R. Standleyi* on the one hand and the most finely dissected states of *R. foeniculacea* of the South American Andes.

Psilogramme Jimenezii Maxon, sp. nov.

Rhizome short-creeping, woody, 3–5 mm. thick, scantily paleaceous, the scales brownish, oblique, subulate-attenuate, rather lax, about 1.5 mm. long, flattish and several cells broad in the basal portion, occasionally toothed toward the apex. Fronds several, approximate, apparently distichous, rigidly ascending from an arcuate base, about 20 cm. long, the stipes mostly shorter than the blades, dull castaneous, stout (2 mm. thick), glabrate; blades oblong-lanceolate, acute at apex, 11–15 cm. long, 4–6 cm. broad, nearly 2-pinnate, the pinnules pinnatifid; rachis stout, subflexuous, dull castaneous, greenish-marginate ventrally, striate dorsally and subfurfuraceous with short branched glandlike trichomes, at length scabrous; larger pinnae about 10 on either side, mostly alternate, subimbricate, spreading, subdeltoid, 2–3 cm. long, 1–1.2 cm. broad, with 3 or 4 pairs of distant, coarsely lobed or pinnatifid pinnules below the obtusish incised apex, these joined by a broadening wing; costae and costules glabrous above, subfurfuraceous beneath with short uviform glandulose trichomes; segments roundish, concave, with deeply recurved-revolute margins, the larger ones 2-lobed or 3-lobed; veins few, running to the emarginate lobes, there greatly enlarged; sporangia numerous, extending in a heavy line nearly throughout the course of the veins, mixed with minute yellowish glandlike hairs. Leaf tissue coriaceous, corrugate above, glabrous throughout.

Type in the U. S. National Herbarium, no. 865086, collected at the crater of Volcán Poás, Costa Rica, altitude 2,800 meters, February, 1915, by Otón Jiménez (no. 1034). A second specimen, received at a later time under the same number and with identical data, is *P. Warscewiczii* (Mett.) Kuhn.

Psilogramme Jimenezii belongs to the group of *P. hirta* (H. B. K.) Kuhn, and among North American species need be compared only with *P. Warscewiczii* and *P. congesta* (Christ) Maxon, of Costa Rica. *P. Warscewizii*, which apparently is common on Poás at 2,300

to 2,640 meters elevation (*Tonduz* 10712; *Donnell Smith* 6930; *Alfaro* 121; *Standley* 34857, 34869) and up to 3,200 meters on Volcán Turrialba (*Pittier* 13256; *Torres* 14; *Standley* 35033), is in general a much larger plant with wide-creeping rhizomes and blades glabrous above; it differs at once in its copious covering of long flexuous septate hairs beneath. *P. congesta*, which is abundant throughout the central table land and mountain regions at 1,300 to well above 2,000 meters, occurs also on the forested upper slopes of Volcán Poás at 2,500 to 2,640 meters, but this is immediately distinguished from *P. Jimenezii* by its thick multicipital rhizomes, cespitose fronds, and abundant long septate-hairy covering throughout, as well as in many minor characters. Neither of these species possesses the short uviform trichomes, with glandlike processes, which impart a glandular-scurfy appearance to the vascular parts of *P. Jimenezii* beneath. The complete absence of long septate hairs throughout is a conspicuous character of the new species.

Dryopteris Killipii C. Chr. & Maxon, sp. nov.

Rhizome short, stout, ascending, densely paleaceous, the scales suberect, tufted, bright brown, narrowly subulate-attenuate, 1–2 cm. long, rather thin, mostly involute or twisted, denticulate. Fronds 4 or 5, subfasciculate, suberect, about 2 meters long, the stipes slightly longer than the blades, stout, yellowish-brown, lustrous, strongly paleaceous, the scales persistent, rufous-brownish, thin, lanceolate, hair-pointed, denticulate-fimbriate, the larger ones divergent, underlaid by numerous smaller, thinner, peltately affixed appressed scales, a similar covering of hairlike scales extending to all the rachises and to the costules and veins of the ultimate segments beneath; blades deltoid, acute, up to 1 meter long and 90 cm. broad, 4-pinnate-pinnatifid, the pinnae spreading; basal pinnae deltoid, acuminate, 45 cm. long, 30 cm. broad, stalked (5 cm.), inequilateral

though not strongly basiscopic, the proximal basal pinnule subdeltoid, 15–17 cm. long, 10 cm. broad, stalked (1.5–1.8 cm.), long-acuminate; pinnules of the third order ovate-oblong to triangular-oblong, acuminate, the larger ones 4–6 cm. long, 1–2 cm. broad, stalked (2–5 mm.); larger pinnules of the fourth order 10–15 mm. long, rather obtuse, obliquely incised nearly to the costa into 4 or 5 pairs of acutish ultimate segments, the larger of these often sharply toothed distally; basal pinnules of all orders nearly opposite, the upper ones alternate, those of the third and fourth orders inequilateral at base, the distal divisions elongate; costae and costules densely puberulous above with short brown intestiniform hairs, the upper leaf surface glabrous; under side of segments beset with very minute, thick, lustrous, yellow, glandlike hairs, freely so along the veins; sori few, distant, nearly confined to the distal side of the ultimate divisions, dorsal, the usually simple veinlet not attaining the apex of the sharply acute lobe; sporangia numerous, bearing a short-stalked yellow gland upon the pedicel; indusia large, coriaceous, roundish-reniform, glabrous, subpeltate. Leaf tissue firmly membrano-herbaceous, brownish in drying.

Type in the U. S. National Herbarium, no. 1,207,594, collected in humid forest of the Río Caldera watershed, west of El Boquete, Chiriquí, Panama, at an altitude of 1,900 meters, February 17–19, 1917, by Ellsworth P. Killip (no. 5360). The species is represented also by a second collection (*Killip* 5293) with nearly identical data, and by a single Costa Rican specimen (Santa Clara de Cartago, 1,950 meters, *Maxon* 8222); the latter, though small and sterile, is sufficiently complete to afford data as to rhizome characters and proportions of the frond.

Dryopteris Killipii is a strikingly distinct new member of the subgenus *Parapolystichum*. In general architecture it resmbles the common tropical American *D.*

effusa (Sw.) Urban and *D. exculta squamifera* C. Chr., of Costa Rica, but it differs strongly in its stout shaggy stipes and rachises, deltoid non-attenuate blades, minutely paleaceous segments, and large coriaceous indusia. In color and texture it recalls *D. macrostegia* (Hook.) Kuntze and *D. amplissima* (Presl) C. Chr., of South America, belonging to the subgenus *Polystichopsis*.

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Fern Ecology of Barro Colorado Island Panama Canal Zone

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Barro Colorado Island is the largest island in Gatun Lake, the artificial lake formed in 1914 to make up the central portion of the Panama Canal. Its highest elevation is 537 feet. In 1923 the island was set aside by the governor of the Canal Zone as a biological reserve. Subsequently a commodious and comfortable laboratory was erected on it. It has been visited by numerous biologists, who find in its six square miles of forested area and along its twenty-five miles of shore line a wealth of material for research in tropical biology.

The region is a tropical rain forest of a somewhat dry type, i. e. including a number of periodic or monsoon plant types. The annual rainfall is close to 115 inches. Half the area of the island is primeval forest, the remainder being second growth, with only an occasional small clearing.

Mr. Paul C. Standley (The ferns of Barro Colorado Island. AMERICAN FERN JOURNAL **16**: 112–120; **17**: 1–8. 1926, 1927) lists forty-four species of ferns and fern allies from the island. The writer by collections made during July and August added twenty-eight others, giv-